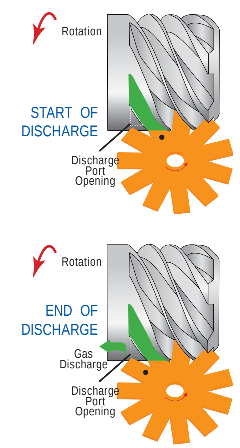
Multi-position suction strainer cover and stop check valve — Can be mounted on either side in five rotated positions.

Parallex™ slide system — It's the key to part load efficiencies far superior to twin screw compressors. Capacity and volume slides (with an expanded volume ratio of 1.2 to 7.0) move independently of each other based on load, eliminating over or under compression and saving motor horsepower.

Oil Cooling Options—
- Thermosyphon
- Water Cooled
- Liquid Injection
- V-Plus

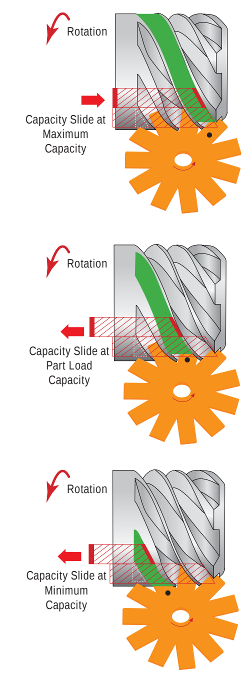
DISCHARGE PROCESS



The gas in the groove is at discharge pressure. The main screw aligns with the discharge port in the housing and pushes the gas through the port into the discharge chamber.

All of the gas that was trapped in the groove is pushed out. The volume of the groove is reduced to zero.

CAPACITY CONTROL

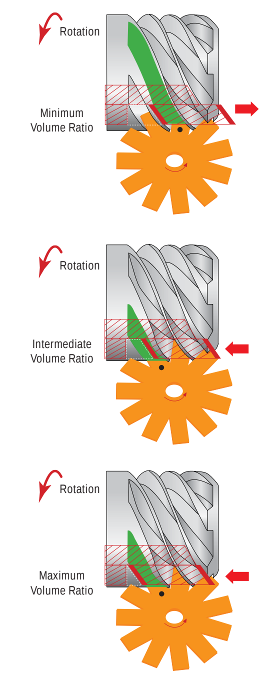


The maximum volume of gas is trapped in the groove.

Approximately 50% of the volume of the groove is trapped and allowed to be compressed.

Approximately 20% of the volume of the groove is trapped and allowed to be compressed.

VOLUME RATIO CONTROLS

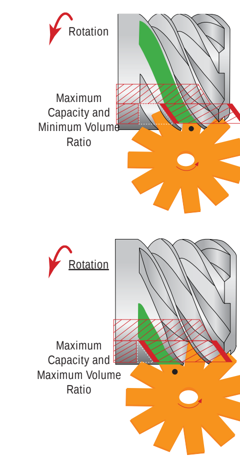


The discharge port opens early in the cycle allowing only a small reduction in volume and a small increase in pressure.

The discharge port opens later in the cycle allowing a significant reduction in volume and a significant increase in pressure.

The slide and resulting discharge port location are in the maximum position resulting in the maximum reduction in volume and a maximum increase in discharge pressure.

CAPACITY & VOLUME RATIO CONTROLS



The capacity slide is set to compress the maximum (100%) of the swept volume while the volume slide is set to allow a minimal increase in discharge pressure.

The capacity slide is set to compress the maximum (100%) of the swept volume while the volume slide is set to allow a maximum increase in discharge pressure.

isolated from the main screw. Since the gaterotor assemblies are independent and do not interfere with the rest of the main screw body, bearings can be sized for maximum reliability.

Sealing During Compression

Sealing is accomplished by the combination of precision running clearances and an injected liquid (coolant/lubricant) which is allowed to leak through and thus seal the clearances during the compression process. In the Single Screw compressor, this liquid must also have adequate viscosity to lubricate the bearings. The liquid is swept into the groove during the suction process and also injected into the compression groove during the compression process to maximize sealing of the running clearances.

Due to the rotation of the screw, centrifugal force impels the injected liquid to the circumferential clearance volume between the screw and the housing. This minimizes the leakage described as cascading. Cascading is defined as the leakage from the high pressure groove past the land separating the grooves into the trailing low pressure groove. Another inherent attribute of the Single Screw design is that there is more surface area on the lands near the discharge end of the groove than near the middle of the groove. This attribute also minimizes leakage from the highest pressure region of the groove. Another area where the leakage is minimized is between the high pressure end of the groove to the volume behind the screw which is at suction pressure. This potential leak path is sealed by means of a non-contacting hydrodynamic seal known as a viscoseal, windback seal, or labyrinth seal.

Shaft Seal System

A shaft seal system prevents any of the process gas from leaking around the drive shaft of the main screw to the environment. The oil flooded Single Screw compressor has two seal types; the standard single mechanical face seal or a triple mechanical face seal with purge capabilities depending on the process requirements. The stationary carbon face of the seal rides on a hydrodynamic film of oil on the rotating mating ring which is fixed on the shaft. The optional triple seal allows various options including a purge and vent to be connected to the housing thus adding a secondary safety buffer during operation. The incorporation of this seal is shown in the cross-section of the oil flooded gas end.

Design

Each rotating assembly within the gas end has two sets of bearings. A typical oil flooded Single Screw compressor consists of two rotating gaterotor assemblies and a main screw assembly, each having one pair of angular contact bearings to maintain axial position of the assembly and a cylindrical roller bearing to support the opposite end. All of the bearings are pressure fed with oil. The oil, upon draining from the bearings, is drawn into the suction of the main screw and is discharged with the process gas and injected oil. Since the main screw has no loads except for gravity, the bearings are considered over designed since they are determined by the required shaft diameter for the applied horsepower. The Single Screw design does not restrict the bearing sizes for the gaterotor supports. As a result, the bearings are optimized for maximum reliability.

Slide Design

The dual slide design on the Vilter Single Screw compressor offers the highest level of flexibility and performance optimization for screw compressors. This design actually has two slides per compression side of the gas end. The two slides are commonly referred to as the capacity slide and the volume slide. The capacity slide moves from positions of 20% to 100% of flow to allow the compressor to match the system flow requirements. Although lower flow rates are possible, they are not recommended since this reduces the amount of oil flowing through the gas end and may result in overheating. The volume slide allows the discharge port to be positioned in the optimum location depending on the capacity slide location, the properties of the gas and the injectant.

A unique feature of the dual slide design is that it allows the compressor to start completely unloaded. This is unlike any other screw compressor. When both slides are in the open position an unrestricted flow path through the compressor is created. If for any reason the gas end is completely full of oil, the position of the slides on startup will allow the oil to be swept out of the gas end thus preventing the possibility of hydraulic lock. The slides also allow the operation at extremely low ratios down to 1.2. However, the recommended operating points for optimum design efficiency occurs at pressure ratios of 2.0 and greater. Due to their design, Single Screw compressors are able to operate more efficiently and reliably with higher suction pressures and lower ratios than other types of screw compressors.

Since the capacity and volume slides operate in parallel (not in series like other types of screw compressors), an important feature of the Single Screw compressor is the ability to operate with optimum efficiency even at part load conditions. Other types of screw compressors have dual slides which operate in series. This results in one of the slides blocking off some of the porting behind the other slide creating a restriction and performance penalty at part load conditions.

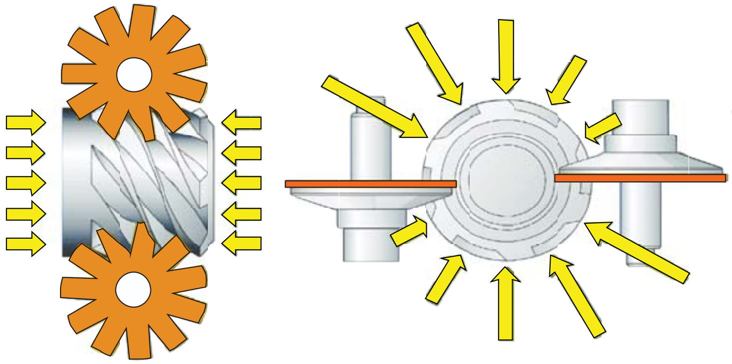
Conclusion

The Vilter single screw compressor with the 5/15-year warranty and Parallex™ slide system makes it the most efficient and reliable compressor in the world. It's superior to any other single screw and most certainly every twin screw.

Thousands of single screws are in operation worldwide for gas compression, air conditioning, refrigeration, and petrochemical industries.

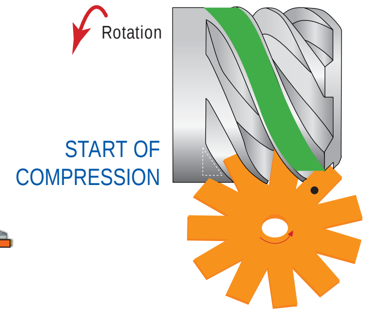
Vilter Single Screw Compressor – Design and Operation

BALANCED LOADING

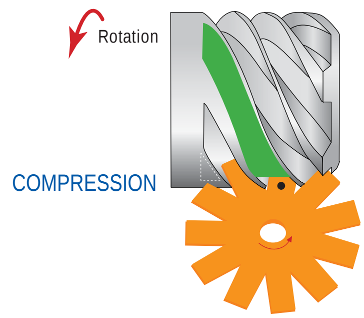


The single screw compressor has no radial or axial loads on the main screw.

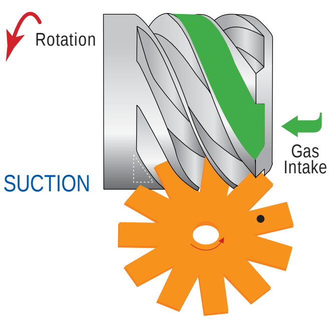
COMPRESSION PROCESS



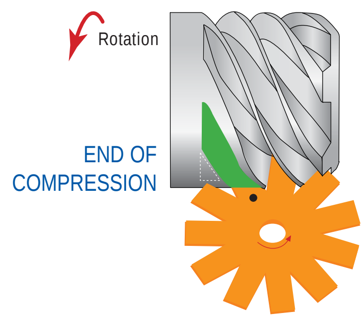
The gas is trapped in the groove at suction pressure.



As the groove volume is decreased, the pressure in the groove increases.



As the groove increases to maximum, the gas flows into the open grooves.



The gas continues to be compressed until it reaches the minimum volume and maximum pressure for the application.

Theory

The compression cycle begins after suction gas fills the top and bottom grooves of the main screw at the suction end of the casing. Since the screw compressor has a gaterotor(s), the compression process occurs simultaneously on opposite sides of the screw; the top and bottom. As the main screw rotates, it in turn drives the gaterotor(s). The engagement of the gaterotor with a screw groove traps the suction gas and begins the compression process. As the screw rotates, the engagement of the gaterotor continues, thus reducing the initial volume of the groove and increasing the pressure in the groove. Once again this occurs simultaneously on opposite sides of the screw.

Finally, as the main screw rotates toward the completion of the compression cycle, the groove aligns with a port in the housing at the discharge end of the casing. The gas and any liquid in the groove are radially discharged through the port into the discharge plenum. Since there are six grooves in the main screw, the compression process simultaneously occurs six times in two locations per revolution of the screw. Operation at 3600 RPM results in 21,600 simultaneous compression strokes at the top and bottom grooves per minute and a relatively smooth flow of discharge gas.

Balanced Loading

One advantage of the Single Screw compressor is the fact that there are no net radial or axial forces exerted on the main screw or drive shaft components due to the work of compression. Since the compression process occurs symmetrically and simultaneously on opposite sides of the screw, the forces due to compression are canceled out. The only vertical loads exerted on the main screw bearings are due to gravity. Since the discharge end of the screw is vented to suction, the suction gas pressure is exerted on both ends of the screw resulting in balanced axial loads.

The Single Screw has an inherent design advantage of reduced loading during the compression process. This is due to the fact that the gaterotor tooth area decreases as the gas pressure in the groove approaches discharge pressure.
When the gaterotor first engages with the main screw the compression process begins. As rotation continues, the gaterotor tooth area exposed to the gas pressure increases. The resultant force creates the axial loads on the gaterotor assembly. Approximately half way through the stroke, or when the radial axis of the gaterotor is perpendicular to the rotational axis of the main screw, the maximum area of the gaterotor is exposed to the gas pressure. As the compression cycle continues, the pressure within the groove increases but the area of the gaterotor exposed to the discharge pressure continues to decrease. The lower loads transmitted to the components and bearings result in higher reliability. At the end of the stroke, the area of the gaterotor has been reduced to zero as it disengages from the main screw.

Another design feature of the Single Screw compressor that enhances reliability is the loads on the gaterotor assemblies are well defined and

Tradition & Technology

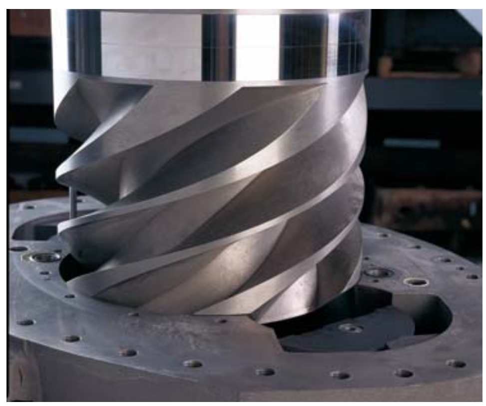
Together. Working For You.

ViSSion™ Micro-Controller
Vilter's ViSSion Micro-Controller runs includes a touch screen graphic display, and is UL and CU approved. The panel includes safety controls, automatic and manual operation, password protection, maintenance tracking, graphical trending, compressor sequencing, and remote accessibility.

Block and bleed valves are standard

The VSM is the latest in Vilter's long respected line of compressors for industrial cooling applications. The VSM, featuring Vilter's signature single screw design, utilizes a direct drive, c-flange mounted motor. The VSM design results in significantly decreased sound levels making it much quieter than twin screw models.

Its compact design has no external tubing on the compressor, no gear box and an optional oil pump (based on application), reducing your operating costs. Plus, it features the ViSSion Micro-Controller and our exceptional 5/15 warranty.



5/15 WARRANTY™

VSM Specifications

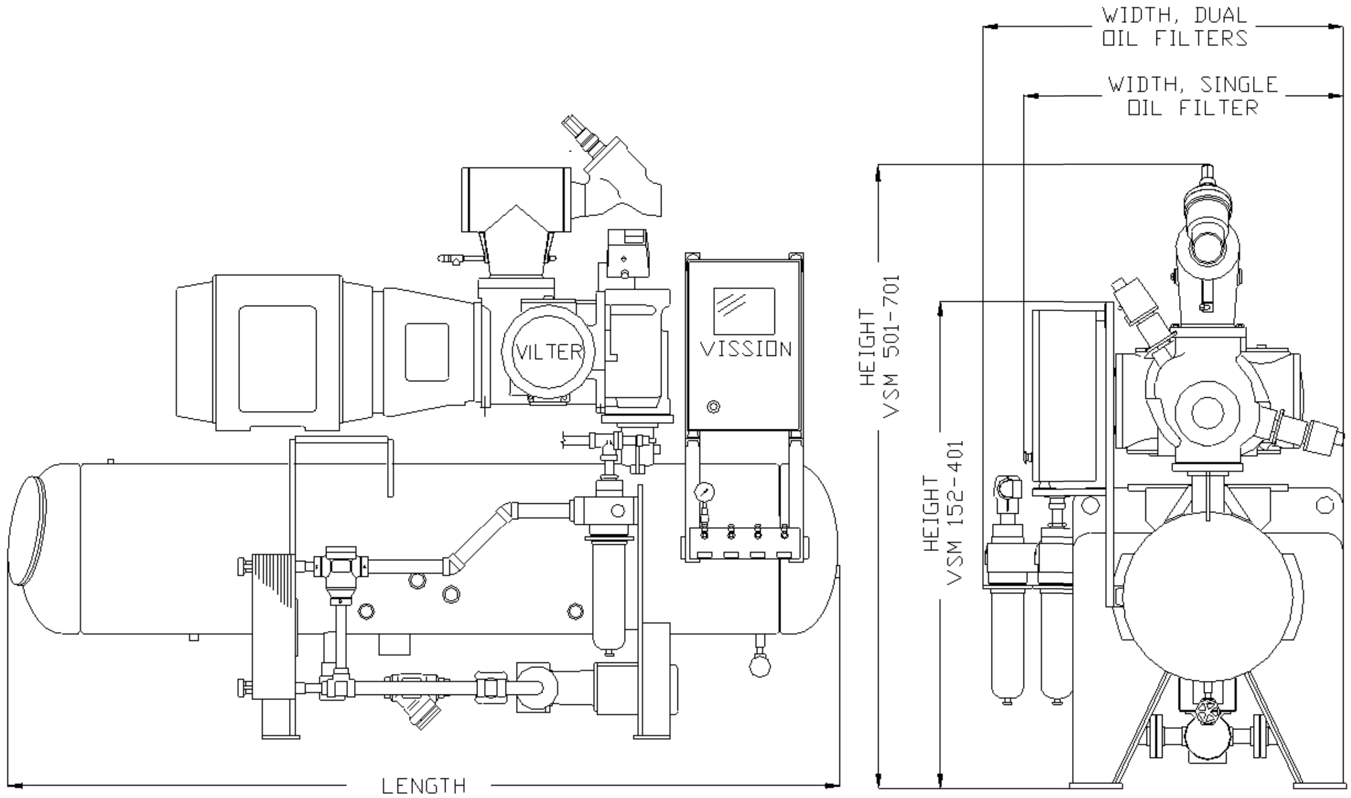
Vilter Model Number	CFM**	Base Ratings (a) Ammonia Tons	Ammonia BHP	R-22 Tons	R-22 BHP	Standard Connection Sizes Suction	Discharge	Unit Dimensions and Weights (b) Length	Width, Single Oil Filter	Width, Dual Oil Filters	Height	Shipping Weight (lbs)
VSM-152*	152	52	76	50	78	3	3	8'-2"	3'-7"	3'-11"	5'-9"	3800
VSM-152E*		57	79	60	85							
VSM-182*	177	61	84	58	87	3	3	8'-2"	3'-7"	3'-11"	5'-9"	3800
VSM-182E*		68	88	70	96							
VSM-202*	202	72	93	67	98	3	3	8'-2"	3'-7"	3'-11"	5'-9"	3950
VSM-202E*		79	98	81	107							
VSM-301	305	107	133	101	136	3	3	8'-2"	3'-7"	3'-11"	5'-9"	4100
VSM-301E		111	139	119	147							
VSM-361	353	136	151	118	155	3	3	8'-2"	3'-7"	3'-11"	5'-9"	4100
VSM-361E		139	158	139	168							
VSM-401	405	146	169	135	175	4	3	8'-2"	3'-9"	3'-11"	5'-9"	5000
VSM-401E		161	178	160	190							
VSM-501	502	185	202	173	207	4	3	8'-2"	3'-9"	4'-0"	6'-11"	6150
VSM-501E		203	213	199	220							
VSM-601	609	229	241	211	237	4	4	9'-9"	3'-11"	4'-5"	7'-3"	6700
VSM-601E		252	254	245	255							
VSM-701	691	260	272	239	264	5	4	9'-9"	3'-11"	4'-5"	7'-9"	6900
VSM-701E		285	287	276	283							

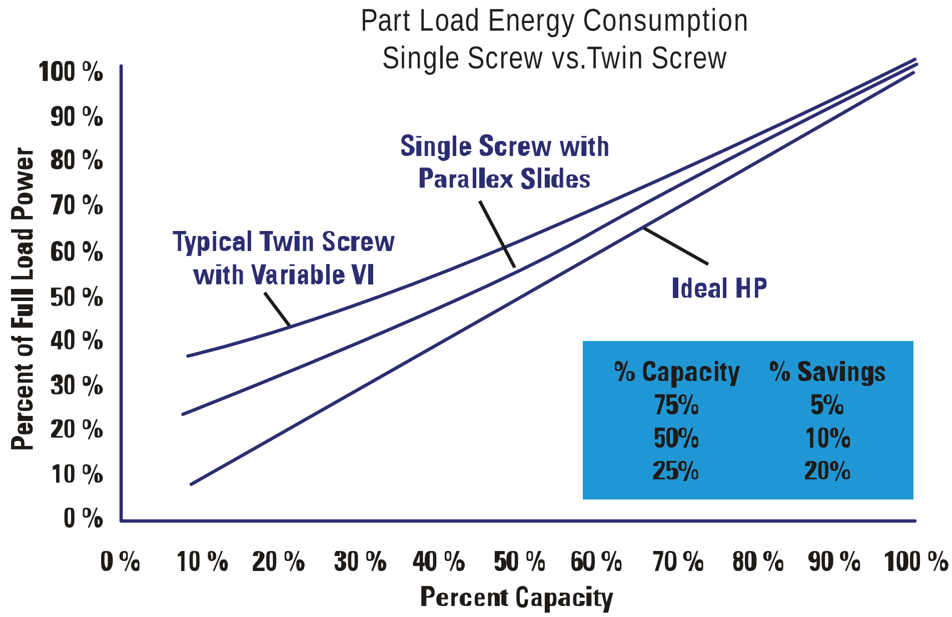
(a) Tons and BHP based on + 20°F and 95°F; 10°F liquid subcooling, saturated suction.
Ratings for other refrigerants are available, consult Vilter for more informationon.

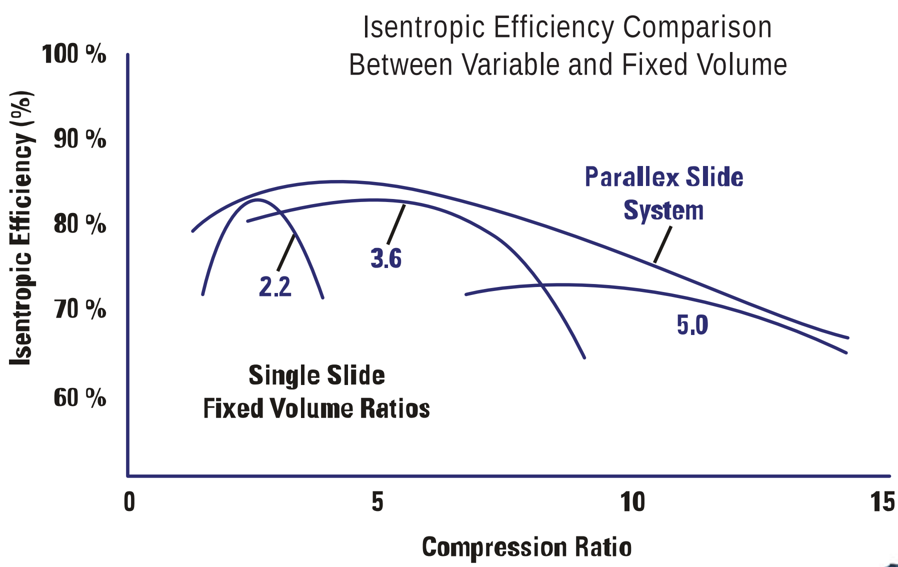
(b) Dimensions and weights are approximate, and are based on use with thermosiphon plate oil cooling, standard size oil separator and standard motor.

* Models operate at 1775 RPM; all others operate at 3550 RPM

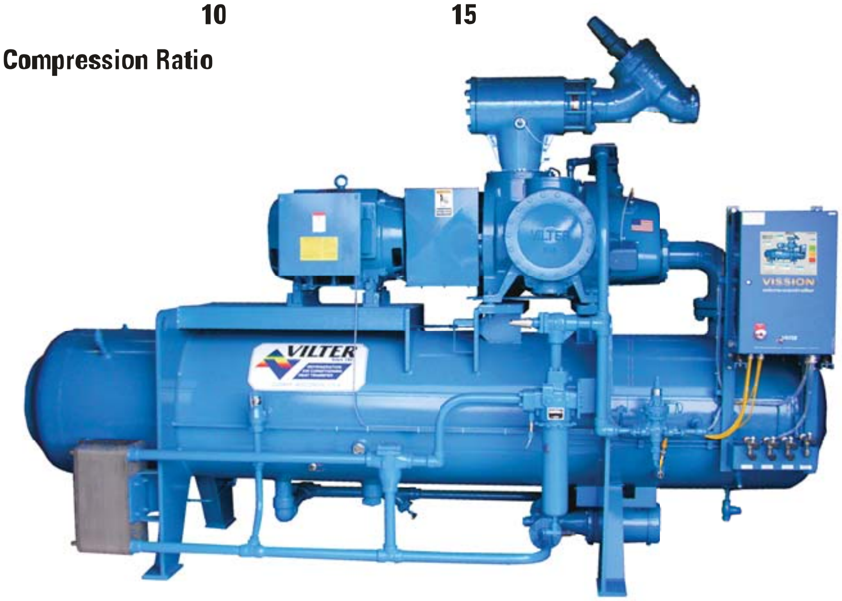
** CFM's Based on test data.







VSM Single Screw Compressor
From Nominal 150 CFM thru 700 CFM



VSS Single Screw Compressor
From Nominal 750 CFM thru 3000 CFM